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by
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National Aeronautics and Space Administration

SECOND NATIONAL CONFERENCE ON THE
PEACEFUL USES OF SPACE
Seattle, Washington
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"<u>The Role of Government in Scientific Exploration</u>"

It is a pleasure to be here this evening, on the grounds of this great international exposition, to participate in the Second National Conference on the Peaceful Uses of Space. I am grateful to Governor Rosselini and Senator Magnuson for the warm welcome which they extended at the opening meeting this morning. The participation of your great senior senator is particularly appreciated, for it has been my privilege to know and respect him in his vital role as Chairman of the Committee on Interstate and Foreign Commerce of the United States Senate.

Those of us who are devoting our time and our energy to the mastery of space can also be grateful to Century 21, the City of Seattle and the State of Washington for creating an atmosphere here which certainly was designed to make us feel at home.

I might say that I have <u>felt</u> a few space needles in my time, when we have had to postpone flights to assure the best conditions for success, or when one of our launch vehicles failed to do what it was supposed to do, but this is the first time that I have <u>seen</u> one.

One cannot tour the grounds of this imposing exposition without being impressed with it as a demonstration of the pace at which we are moving in this age of space. When the idea of the Seattle World's Fair was first proposed in 1955, the first satellite had yet to be launched, and the National Aeronautics and Space Administration did not yet exist.

Century 21, as many of you may know, was not originally proposed as the showcase for space science and technology which it has become.

Rather, those who conceived the idea of this event envisioned it as a 50th anniversary celebration of the Alaska-Yukon-Pacific Exposition. This event, held here in 1909, was conducted to highlight the progress made by Seattle and the Pacific Northwest following the Klondike gold strike in 1898 -- an event which touched off a population explosion in this area.

It is apparent, observing Century 21 as it stands here today, that its planners were men of vision as well as imagination. They have kept abreast of the astonishing scientific and technological progress which has occurred in the short span of years since the idea of Century 21 was born.

As a result, rather than commemorating the activities of those pioneers who first went to the Yukon to dig for gold, the exposition has as its symbol the towering space needle, acknowledging the efforts of a new group of pioneers who are soaring into space in search of new treasures to be found there.

To me, this rapid change in the emphasis of Century 21 -- and remember, the symbolic space needle was not even thought of until three years ago -- is evidence of the readiness of this generation to accept and pursue new ideas which were considered visionary, if not actually ridiculous, only a few years ago.

Even more significant is the change in the attitude of citizens toward federal participation in and support of the kind of scientific research, development and exploration which our accelerated national space program represents.

Throughout this conference, the details of this national space program will be thoroughly examined by able speakers and participants who are interested in space, many of whom are associated with NASA and its industrial and educational contractors. I shall not, therefore, attempt to discuss the program of the National Aeronautics and Space Administration in detail. Rather, I would like to explore with you the thought which I have just mentioned -- the developing role of federal agencies in scientific research and exploration, and the relationships of the NASA organization with the President, the Congress, other agencies of our government, and with foreign governments.

In considering the remarks which I would make here tonight, I could not help reflecting on the early role of the Pacific Northwest in government-sponsored scientific exploration. This area -- today the host of a conference on the problems of exploring what President Kennedy has so aptly called "a new ocean" -- was actually the target of the United States' first major scientific expedition.

The role of government in science has been the subject of national debate since this nation was born. Thomas Jefferson, as early as 1783, talked to George Rogers Clark about conducting an expedition up the Missouri River, and, as President of the United States in 1803, sent a secret message to the Congress requesting $2,500 to finance what was to become known as the Lewis and Clark expedition. (Not, incidentally, the same Clark. This one's first name was William.)

The Congress of that day, and to a lesser degree throughout the first century and a half of our national existence, was reluctant to invest in scientific research. This attitude was largely responsible for the fact that on the eve of World War II, despite our great technological prowess, we were still almost totally reliant for basic knowledge on European research.

Jefferson got his appropriation, but not without resorting to some mild deception. While telling the envoys of France and Spain that the objectives of the expedition were to enlarge scientific knowledge, he sold it to the Congress "for the purpose of extending the external commerce of the United States."

His real objectives were evident, however, when he confronted that problem of recruiting personnel for the expedition -- a problem with which we have great sympathy, for it is still with us today.

He wrote: "We cannot in the United States find a person who to courage, prudence, habits and health adapted to the woods, and some familiarity with the Indian character, joins a perfect knowledge of botany, natural history, mineralogy and astronomy, all of which would be desirable."

Jefferson never did find this paragon, and in the end settled for his secretary, Captain Meriwether Lewis, who had "all the first qualifications." Captain Lewis' lack in scientific knowledge was overcome by sending him to Philadelphia for several weeks, where the learned gentlemen of the American Philosophical Society taught him to make celestial observations, to collect plants and animals, and to study the Indians.

I devote so much attention to the Lewis and Clark expedition not only because it was the first such national effort, but because its dramatic success established the precedent for future federal participation in scientific exploration.

During almost a half-century which followed that expedition, men in science and government discussed and debated the Federal role in this form of activity. There was created, in 1807, a bureau that was to become the U. S. Coast and Geodetic Survey and, in 1846, federal scientific activity was enhanced with the creation of the Smithsonian Institution. Subsequently, the Civil War gave the scientists a chance to establish an institution of which they had been dreaming for decades -- the National Academy of Sciences, created in 1863.

Throughout the 19th Century and the early years of our own century, government participation in science and technology experienced a slow but steady growth, largely in agricultural research. Yet, science had not yet come into its own as an instrument of public policy. It took another military conflict -- World War I -- to provide a renewed impetus to governmental scientific activity.

Our national civilian and military leaders, at the beginning of World War I, were forced to a heightened appreciation of the importance of aeronautical science. The early advantages which might have been gained from the pioneer work of Samuel P. Langley and the Wright brothers had largely been overlooked or ignored in this country. The development of aircraft design and technology had been left to the Europeans, and we entered World War I with neither design experience nor manufacturing capability of our own.

Recognition of this deficiency led to the creation by the Congress in 1915, of the National Advisory Committee for Aeronautics, the first war research agency of World War I.

There followed, after the successful conclusion of that great conflict, another period in which federal participation in science lagged, and once again it was a threat to our national security which increased the momentum and broadened federal participation in this activity.

If a line can be drawn across the continuous path of history, it must be said that the year 1940 separates the first century and a half of American experience in this field from the period of accelerated national interest in science which followed.

World War II produced a new awareness of the changing role of science in government. When the atom bombs fell on Hiroshima and Nagasaki -- a result of highly secret government scientific effort in the Manhattan Project -- the entire nation became fully aware, for the first time, of science as a political, economic and social force with which it must reckon.

Consequently, after extensive national debate, the Congress recognized the expanding role of government in science by creating the Atomic Energy Commission in 1946, and the National Science Foundation in 1950. Professor Don K. Price, an outstanding student of the relationships between government and science, described the new attitude well in 1953, when he wrote:

"The United States has come to see that it is in a new kind of rivalry with the Soviet Union -- a rivalry that may well turn, not on territorial or diplomatic gains, or even (in the narrow sense of the word) on military advantage. The crucial advantage in the issue of power is likely to be with the nation whose scientific program can produce the next revolutionary advance in military tactics, following those already made by radar, jet propulsion and nuclear fission.

"Partially obscured by this spectacular military aspect of the role of science, but closely related to it, is its long-range economic aspect. The same fields of technology that are crucial to military tactics -- electronic communications, aeronautics, and power -- are also those that may have great influence in economic competition. The massing of scientific research for attack on military problems has its industrial by-products. In these fields the tremendous military research program is probably pushing our country farther and farther ahead of its competitors."

Professor Price was right on every count but the last -- a fact which became apparent on October 4, 1957, when the ominous beeps of Sputnik I awakened the world to the realization that the Soviet Union had scored an important triumph in a new and exciting area of science and technology.

Within months, the Congress acted to correct this deficiency, and our determination to move forward in space was expressed in the National Aeronautics and Space Act of 1958. In accordance with this Act, the Eisenhower Administration went forward with a long-range plan for space development which, in ordinary circumstances, would have been regarded as rapid and ambitious.

The circumstances, however, proved to be far from ordinary ones. This fact was quickly made apparent to President Kennedy during his first weeks in the Presidency by a series of Soviet achievements which finally included the manned orbiting of the earth by Cosmonaut Gagarin. New circumstances made a new policy imperative.

Recognizing that if a nation so great and powerful as ours has not the will to be first, it shall almost certainly be last, President Kennedy responded promptly to the Soviet challenge, and in his State of the Union Message told the Congress that it was "time to act" to restore American leadership in this vital new field of endeavor. He called for an accelerated space program which would place an American exploratory team on the moon "within this decade," something which otherwise could not be achieved before the mid-1970's.

Sensing the urgency of his request, and responding in a thoroughly non-partisan manner, the Congress quickly approved. This country's most ambitious scientific undertaking was underway.

It is important to consider the significance of these actions as they reflect a further expansion of the role of government in science. A clear understanding of the accelerating growth of Federal participation in scientific research and development can be gained by examining the funding of these activities during the current century. In 1900, federal research and development expenditures were under $10 million annually, with the greater portion of the research devoted to the agricultural sciences.

As recently as 1940, just prior to World War II, Federal R&D outlays were still under $100 million a year. That is about one-fifth of what will have been spent, through Fiscal Year 1963, on the development of a single type of NASA launch vehicle -- the mighty Saturn C-1, which is the most powerful rocket stage known to exist in the world.

With World War II, government-sponsored science and technology really came of age. By 1945, Federal R&D expenditures had risen to $1 billion a year, and by 1953 to $2 billion annually.

During Fiscal Year 1961, the nation's total expenditures for all research and development were $16 billion, about $10.4 billion of which was supplied by Federal appropriation. Of the total, $1.8 billion was for basic research and $3.2 billion for applied research. The balance of $11 billion was spent for development. The Federal government supported 60 per cent of the nation's total activity in basic research.

Final figures on the government expenditures for the current fiscal year are not yet available. However, in FY 1962, the Congress appropriated to some 38 agencies in the Executive Branch of the government a total of $10.8 billion for research and development -- this is about two-thirds of what will be spent this fiscal year in the nation for this purpose from both public and private funds. About three-fourths of the total Federal expenditure was allocated to NASA and the Department of Defense -- $1.4 billion to NASA, $6.2 billion to DOD.

We have noted the influence of military requirements in expanding and accelerating government participation in scientific research. We should not overlook the fact that, while heavy emphasis is being placed within NASA on the peaceful uses of space science and technology, military requirements continue to dominate the research and development field.

Authorizations by the Congress for Fiscal Year 1963, already approved by the President, provide a Department of Defense budget for new missiles, aircraft and naval vessels of almost $13 billion. Of this total, slightly over $4 billion is allocated to the Army, Navy, Marine Corps and Air Force, for research, development and hardware in their missile programs.

A comparable figure in NASA would be the sum which the President has requested for research and development, not yet authorized by the Congress, an amount slightly under $3 billion. This is less than three-fourths of the Department of Defense authorization for new missiles, and less than one-fourth of the DOD authorizations for aircraft, missiles and ships.

We should also remember that the NASA expenditures are devoted exclusively to research and development which will make a continuing contribution to our knowledge of space science and technology. NASA has no appropriations for expendable hardware, other than that constructed for developmental purposes. Thus, all of NASA's research and development expenditures make a lasting contribution to human knowledge.

I do not remind you of this to minimize the vital importance of the Department of Defense programs for our national defense, but merely to indicate that NASA expenditures are not duplicative of that effort. Instead, they exist for purposes which not only supplement, but transcend the national defense and security.

Another point which I should like to emphasize about this vastly increased Federal participation in scientific research is the extent to which it acknowledges -- and rather belatedly -- the necessity for this nation to produce its own basic research. As I have indicated, despite our great technological advances, the United States was for too many years content to rely on the scientists of other nations for the basic scientific research efforts on which this technology was based.

The great technological progress made during World War II exploited and developed much of that basic knowledge. The reservoir was beginning to run dry. Meanwhile, in the rehabilitation of the European nations, increasing emphasis was being placed on technology, rather than basic science, and fewer advanced degrees were being granted. It became apparent that, if we were to satisfy our needs for basic knowledge -- outside of the work going on in the Soviet Union -- we would have to produce it ourselves.

If we are to survive in a scientifically-oriented world and be, as President Kennedy has urged, "in a position second to none," a great deal remains to be done.

I have indicated that during Fiscal Year 1961, the total national expenditure for basic scientific research -- by government, educational institutions, private foundations and industry -- was $1.8 billion. The National Science Foundation estimates that by 1970, nearly $3 billion per year will be required for basic research alone -- more than double the amount expended last year.

The professional staffing in universities and colleges will have to increase from the present 45,000 to 85,000 full-time positions to perform the universities' share. This means adding 4,000 full-time researchers in our universities every year. Actually, since many university researchers are on a part-time basis only, the number of new professional personnel will be much greater.

Such an upsurge in research and development also means, according to the Science Foundation, that professional teaching staffs for science and engineering in our universities and colleges must increase from 100,000 to 175,000 full-time positions by 1970. That is 7,500 new teachers of science and engineering at the University level every year.

Remember, this is the impact on university staffs alone. It does not include the new scientists and engineers needed directly in government and industry undertakings.

The fact that, as one historian has put it, "government and science have joined in a national enterprise born of necessity and sustained by the challenges and complexities of the modern world," is readily justified by the circumstances which confront us.

Major scientific advances today require group efforts, expensive equipment, and massive technological support, often over many years of sustained effort. Only government can marshal the resources to organize and finance such endeavors. Private enterprise stands ready to take up feasible and saleable applications as they can be identified, but many of the pioneering opportunities now opening up on the frontiers of science require such large investments that they first must be developed to meet governmental requirements if they are to be made available for the benefit of mankind.

In a directed society, such as that of the Soviet Union, implementation of public policy in the field of science, or any other, for that matter, is less complex. There, government officials decide who will be trained and educated to perform needed tasks, and the extent to which the Russians regard science and engineering as essential is now readily apparent in the enormous increase in advanced degrees in these fields which have been granted in the Soviet Union during recent years.

In our own society, where individual interests and desires govern the choice of a career, our problems are more difficult, yet I am confident that they will be met and overcome, within the framework of our democratic principles, as they have been in the past.

But the question of science and public policy does not end with the recognition of Federal responsibility. Of equal importance is the determination of how the government shall carry out its responsibilities; how it apportions the work between industry, government laboratories and educational institutions; how the views of the scientific community are taken into account; how the traditional independence of the university professor, researcher and student are to be safeguarded; how national goals are to be established and achieved.

The establishment and implementation of our program of space research and technological development involves a coordination of national skills and facilities which touches every facet of our society and is unequalled in complexity by any previous undertaking. Involved are the President, the Congress, other government agencies, foreign governments, educational institutions and public purpose foundations and the private industries and commercial enterprises of the nation.

The blending and welding together of this complex of individuals, groups and organizations constitutes an almost superhuman challenge, but one to which our form of government is proving itself equal.

It might be well, to complete our understanding of how the nation's space program is conceived and operated, to review briefly the roles of these varied groups and agencies. The National Aeronautics and Space Act of 1958 established four major objectives:

1. To conduct scientific exploration of space.

2. To conduct manned exploration of space.

3. To apply space science and technology to the development of earth satellites for peaceful purposes, to promote human welfare.

4. To develop space science and technology in the interests of the national defense.

In practice, the first three of these broad objectives, those which are non-military in character, have become the responsibility of the National Aeronautics and Space Administration. Military efforts in space are the responsibility of the Department of Defense.

In developing our space program, the agencies involved are required to submit to the Bureau of the Budget, prior to September 15 of each year, a detailed plan of activity and statement of the funds required to support it. During the ensuing weeks this program is reviewed by the Budget Bureau with the participation of agency representatives, and a budget recommendation made to the President about December 1. The President then reviews the request, and by the end of December a final budget is prepared for submission to the Congress, to cover the fiscal year beginning the next July 1st.

In addition to the preparation of the budget itself, NASA also contributes space material to the preparation of the President's State of the Union message, his Budget message, and, where desirable, to his Economic message, and any special messages which he may elect to submit to the Congress.

Following the submission of the budget by the President, the various committees of the two houses begin hearings. A civics book review of the procedure would indicate that the policy aspects of the budget -- the authorizations -- are the initial responsibility of the House Committee on Science and Astronautics and the Senate Committee on Aeronautical and Space Sciences. The actual appropriations would subsequently be determined initially by the Appropriations committees of the two houses, and then be given final approval by the Congress and the President.

In practice, it is not quite that simple. Over the years, the necessity for supporting their proposed authorizations has led the first named committees to become more detailed in dollar authorizations than are the appropriations committees which actually approve the funds. Thus, although a considerable amount of flexibility is retained, we must account annually to the Congress, on a dollar by dollar basis, for each program which we propose to undertake.

This, when you consider that we are already at work on our appropriation request for the fiscal year beginning a year from next July, is no simple task. It is made particularly difficult by the fact that ours is such a fast-paced, rapidly evolving program, in which needs constantly arise which the fertile brains of our scientists have not previously conceived, and which, consequently, cannot be anticipated 18 months in advance.

The Congress has proved to be remarkably understanding and tolerant of these difficulties, however. Where space progress is concerned, I think the attitude of most members is akin to that once expressed by Teddy Roosevelt, speaking of the Panama Canal:

"Instead of debating for half a century before building the canal," Roosevelt said, "better to build the canal first and debate me for a half-century afterward. What this nation will insist upon is that results be achieved. The utmost practicable speed. Push the work rapidly and at the same time with safety and thoroughness."

We like to feel that these words would be applied as well to the program in which we are now engaged.

In addition to these committees with a major interest in space -- and I should note that Washington's distinguished Senator Warren Magnuson, in addition to being chairman of the Commerce committee, also serves on both the Aeronautical and Space Sciences and the Appropriations committee of the Senate -- we are also guided by other committees with a more limited interest in specific NASA activities.

To cite my own experience, during the period from February 27, 1961 to April 17, 1962, I made 31 separate appearances before 12 different committees and subcommittees of the two houses of Congress. Dozens of other NASA officials were also called upon to testify and, in fact, scarcely a day passes upon which some congressional committee is not involved in considering some phase of the space program, either publicly, or in executive session.

These committees included two on which another great citizen of the State of Washington, Senator Henry M. Jackson, is serving with great distinction. I refer to the Joint Committee on Atomic Energy, which shares with us a concern over the development of nuclear rocket engines, and the Senate Committee on Government Operations, which includes among its interests the long-range Federal budgeting for research and development. Other committees before which I appeared were the House Committee on Post Office and Civil Service, which is concerned with the difficulty which salary limitations have imposed on the recruiting of scientific, engineering and managerial talent, and the Commerce committees of the two houses, which are concerned with the communications satellite program, which is moving rapidly from the developmental to the operational stage.

While a great deal of time is consumed in these congressional hearings, I would like to express the conviction that it is time well spent, offering as it does a mutual opportunity for the exchange of ideas about the course which the nation must pursue in its space program. Our relationships with the Congress have been excellent, and while the various committees and the Congress itself have painstakingly examined our requests to assure themselves of their necessity and desirability, there has been no lack of support for programs which are clearly in the national interest.

Because the Space Act has divided responsibility for the peaceful and military aspects of space research and development, a high degree of cooperation has been necessary between the various government agencies in order to insure maximum progress with a minimum of duplication. This is achieved, in part, through the participation of the White House in budget preparation. It is strengthened further by the existence of an unusual agency, the National Aeronautics and Space Council, presided over by Vice President Lyndon Johnson, and including in its membership the Secretaries of State and Defense, the Chairman of the Atomic Energy Commission, and myself.

The Nation is particularly fortunate in having the Vice President as Chairman of this important council. His enthusiasm for progress in space science and technology and his broad knowledge of the problems involved, both strengthened by his years of service as Chairman of the Senate Committee on Aeronautical and Space Sciences, have enabled him to make an enormous contribution to the advancement of United States efforts in space. Those of you who have not yet been privileged to hear him discuss this vital activity will have that pleasure at the banquet on Thursday evening.

In addition, there is a very close working relationship, on a day to day basis, between the government agencies concerned with the program. In our launch vehicle development, we presently are utilizing 10 vehicles of various sizes for numerous scientific and military purposes. In some instances, responsibility for development is in the hands of the Department of Defense. In others, it lies with NASA. Thus, administration becomes highly complex, but has proved to be remarkably successful.

As an example of this complexity, I might give you the example of the Scout rocket booster. At Point Arguello, California, a situation such as this can occur. The Air Force may, on a given day, launch a Scout rocket built by NASA, with an Air Force ground crew trained by NASA, from a launch pad designed and funded by NASA, controlled from a blockhouse funded by the Air Force. And, perched atop the rocket is an experiment designed and conducted by the Navy. This is an excellent example of the quality of teamwork which has evolved in our space program. In other situations, such as the Dyna-Soar program, the primary responsibility lies with the Air Force, with NASA technical support.

But the Department of Defense is only one of many federal agencies with which we cooperate. To name a few others, we work with the Weather Bureau on meteorological satellites, which are rapidly introducing a new era of weather forecasting. We cooperate with the FAA and DOD in research on supersonic transport aircraft. We cooperate with the Atomic Energy Commission, as noted, on development of nuclear rocket engines. We work with the Smithsonian Astrophysical Observatory. The Navy provides extensive and generous assistance in our Mercury recovery operations, and our development of the X-15 research airplane is closely coordinated with both the Air Force and the Navy. This is only a partial list of the agencies with whom we enjoy a close working relationship.

Outside the government, NASA has developed a very good liaison with the nation's educational institutions. We look to the universities to produce the scientific and engineering personnel required to accomplish the space programs and we depend upon them to conduct advanced research and development. The extent and growth of our program of grants and research contracts with educational institutions is illustrated by the fact that NASA awards totaled $11.7 million in FY 1961, an estimated $30 million during the current fiscal year, and are expected to total $65-70 million in FY 1963. Participating institutions of higher learning totaled 65 in 1961, and are estimated at 70 to 75 for 1962 and 90 to 100 for 1963.

In addition, NASA depends upon qualified scientists and engineers in our colleges and universities for professional consultation and advice, and direct participation in our programs as consultants or directors of research projects. Our concern for encouraging greater participation by young people in scientific and engineering fields recently led us to establish fellowship programs with several institutions, and more are contemplated.

American industry, of course, is a major contributor to the space effort. The NASA budget, which will approach the $4 billion mark in Fiscal Year 1963, is largely expended under contract with non-governmental organizations. We estimate that this amount will total more than 90 per cent of our budget in FY 1963.

Although our larger contracts must, of necessity, go to firms with the facilities and management capability to undertake them, subcontractor activity accounts for a major portion of the expenditures. One NASA prime contractor recently released figures showing that during the calendar year 1961, it had used in excess of 9,000 subcontractors and suppliers, located in virtually all of the 50 states.

Another excellent example is the contract for the first stage of the advanced Saturn launch vehicle, known as the S-1B. This contract, which will run through 1966 and will involve in excess of $300 million, was awarded to the Boeing Company here in Seattle. This does not mean, however, that the contract will be of economic benefit only to the Seattle area.

While it calls for a peak employment of some 5,000 people, the S-1B contract will involve production here in Seattle and at Wichita, Kansas; assembly of the vehicle at the NASA Michoud Operations plant at New Orleans; static testing at the NASA Mississippi Test Facility in southwestern Mississippi, and launching at Cape Canaveral, Florida. Literally thousands of subcontractors and suppliers from all over the United States will be involved in the project.

Finally, in welding together all of the phases of our national space program, it must be remembered that we are under a Congressional directive to cooperate in the development of space for peaceful purposes with the other nations of the world. You have seen a recent example of this cooperation with the launching from Cape Canaveral of the first international satellite, a cooperative project with Great Britain which Prime Minister MacMillan named the "Ariel" on his recent visit here. Last month, in addition, two space probes were launched from the NASA facility at Wallops Island, Virginia, in cooperation with Japan.

Other similar ventures are in developmental stages, including sounding rocket launches in cooperation with France, New Zealand, Norway-Denmark, Pakistan and Sweden, and satellite launches with the United Kingdom and Canada. It should also be noted that our successes in Project Mercury relied heavily on the cooperation extended by other nations around the world in developing and operating our tracking and data acquisition network.

Cooperative ground activities have been undertaken with other nations in connection with both communication and meteorological satellite activities. Agreements for the provision of major ground facilities to permit intercontinental testing of communication satellites to be launched later this year by NASA have been concluded with England, France, Germany, Italy and Brazil, and others are being negotiated at this time. In the meteorological satellite program we have concluded agreements with 28 nations around the world.

In its report to the recent meeting of the Committee on Space Research in Washington, the Space Science Board also cited our extensive cooperation in conforming with COSPAR resolutions. The United States has issued launching announcements, distributed current orbital elements for the U. S. satellites and descriptive experimental information, exchanged scientific data and results, and published numerous publications and catalogues detailing its space activities. Training arrangements and graduate fellowships in space science are also made available to representatives of other nations.

As the United States delegate to the COSPAR meeting, Richard W. Porter, of the National Academy of Sciences, said in his report:

"These programs. . . are regarded as vitally important in our country because we look forward to a day when scientists of all nationalities can join in some truly cooperative project to study and explore the universe in the name of all mankind.

"Within the limits of our capability we stand ready to cooperate with scientists of any nation on any space research projects, large or small, which will increase man's knowledge and bring him closer to the stars."

We also are engaged in negotiations with the Soviet Union to determine whether our two nations may find the means to cooperate in the development of space science for peaceful purposes. This is a proposal which the United States has advanced repeatedly, and which the Soviet Union has now indicated some willingness to pursue. Initial discussions have been held, and more are planned. What the result will be remains to be seen.

It must be remembered that in addition to achieving the objectives which have been outlined by the Congress, the nation's space agency must also perform in accordance with certain guidelines established by that body. Among the most important of these are three which deserve special attention.

First, recognizing the opportunity, through our space program, to demonstrate the differences between our space objectives and those of other nations, we are directed not only to cooperate with other nations in space research, but to share our information with the world.

Secondly, and for the same purpose, we are required to conduct our activities in the full light of publicity. We may not choose, as may be the case elsewhere, to publicize our successes and conceal our failures.

Finally, and this is of particular interest to this conference, we are directed to encourage the application of the results of space research to practical uses which will be of immediate or ultimate indirect benefit to mankind.

The hazards in the first two of these mandates are obvious and, frankly, were the object of a great deal of concern during the many and protracted delays which preceded the successful orbital flight of Colonel Glenn. The wisdom of our open approach, however, was fully demonstrated in the international reaction to that mission.

I have read excerpts from literally scores of newspapers published throughout the world following the Glenn mission. Permit me to quote two of them, which are representative of the worldwide reaction to this achievement of the United States:

From Amsterdam:

"Now that the experiment has been crowned with success, those who weigh the advantages and disadvantages of American frankness realize that the advantages outweigh the disadvantages. All the world watched the achievement of the American Astronaut and all the disappointments about earlier setbacks seemed to vanish. The Americans have taken and accepted the risk of failure before the entire world. Isn't this more refreshing, and above all, more human?"

And from Brazil:

". . .the United States ran a great risk: Announced and postponed so many times with the attention of the whole world focused on her, failure of Glenn's flight would have appeared to the less informed as a North American defeat. This makes the feat even more outstanding and it must be credited not only to the United States but to the Democratic way of life -- to the free world."

And now a word about the final directive -- that the fruits of space research be applied for the benefit of mankind.

Attending, as you are, a conference on the peaceful uses of space, I know that all of you are familiar with much of the work which we are doing in this field. Our activities in the development of communications satellites, meteorological satellites and navigation satellites have been, or will be, described to you in great detail. All of them offer great promise.

In addition, however, we are undertaking a program for the practical application of space science and technology which is unique.

Each of the great scientific and technological revolutions of the past has produced countless new methods, ideas and materials which have altered the course of our existence. In some instances these were totally new ideas and concepts discovered in the course of research devoted toward other goals. In other instances, ideas and methods long known suddenly become applicable to practical, everyday purposes because further developmental work, designed for other purposes, rendered them suitable for mass production at costs within the public reach.

Many of the great scientific discoveries of the past occurred by accident. We even have a word - serendipity - to describe this process.

Accidental observations led Priestley to discover oxygen, Willson to discover calcium carbide, Goodyear to develop the vulcanization process, Roentgen to discover the X-ray which led, ultimately, to photography, and Becquerel to discover radio-activity. Other accidental discoveries, whose number is almost limitless, include the discovery of specific gravity by Archimedes, dynamite by Nobel, aniline dye by Perkin, and if you will, the discovery of America by Christopher Columbus.

Space research is already producing spin-off benefits in the form of new products, new methods, and new materials which can be employed in the manufacture of countless articles for human use. Yet we have scarcely scratched the surface as far as these benefits are concerned.

We have as a goal the exploration of the moon, but that is not an end in itself, nor do we propose to overlook the opportunities which present themselves along the way. We are determined that the huge sums which are required to fulfill our objectives in space research and exploration will also provide the maximum amount of auxiliary benefit which can be obtained.

To this end, we will not be content to have these benefits come only as the result of fortunate accidents. Rather, we hope to seek out and identify results of space research which can have practical applications, and to make this knowledge available now to those with the capability to develop and utilize it for the benefit of every citizen.

Recently, we have undertaken an initial pilot program in this field, which is being conducted in six Midwestern states. A NASA contractor is seeking practical applications of space science and technology, and working with private industries to make certain that their benefits will become available to the public. If this program proves as effective as we hope, and we have reason to believe that it will, it will be expanded to include other sections of the nation as well.

The other day I came across a novel, written in 1894 by a man whose grandfather, only a few years after the expedition of Lewis and Clark, opened a fur trading post not far from here, at the mouth of the Columbia river.

The grandson, John Jacob Astor, shared his ancestor's vision and curiosity. In addition to building the Waldorf-Astoria hotel, he invented things ranging from turbine engines to bicycle brakes. Everything about the man was dramatic, even death, for he went down on the Titanic.

Mr. Astor's novel, "Journey to Other Worlds," was an early form of science fiction, involving space travel to the planets. It was startling, considering the fact that the book was written almost three-quarters of a century ago, to find in it an artist's sketch of a spacecraft hurtling through the universe. Even more startling was the fact that, in design, it was so much like our present concept of the Apollo spacecraft it could almost have been drawn by one of our own engineers.

In the preface, Mr. Astor sounded a note which, had it been heeded in his day, would have vastly advanced scientific and technological progress, and which has real application and meaning even today. He wrote:

"There can be no question that there are many forces and influences in nature whose existence we as yet little more than suspect. How. . .interesting it would be if, instead of reciting (our) past achievements. . .(we would devote our) consideration to what we do <u>not</u> know.

"It is only through investigation and research that inventions come; we may not find what we are in search of, but may discover something of perhaps greater moment. It is probable that the principal glories of the future will be found in as yet untrodden paths."

Tonight, as we assess our position one year after the first Conference on the Peaceful Uses of Space, some of the visions to be found on those untrodden paths have already opened to us. Those which remain offer a challenge unequaled in the history of mankind.